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Fermented sausage casings

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Abstract

Casing is part of sausages, giving it shape, size and integrity, but also having a role in volumetric, structural and chemical changes which occur in sausage during different production phases. For fermented sausages, natural or artificial casings can be used. Artificial casings have an advantage from the hygienic point of view, because microbiological contamination is negligible, storage at low temperatures unnecessary, and there is no problem with product spoilage during storage and transport. Today, artificial sausage casings are a better choice for production of large diameter sausages, while they are equivalent to natural casings for production of small diameter sausages.

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Keywords: fermented sausage; natural casings; artificial casings

1. Introduction

Casing is an integral part of sausage, separating it from the surrounding environment and making it an independent unit. But its role cannot be reduced to simply providing shape, size and integrity of sausages. The function of sausage casing begins at the moment of stuffing and ends at the consumer table. The casing plays both

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direct and indirect roles in the volumetric, structural and chemical changes which occur in the sausage during processing steps. Thus, it is not surprising that a universal casing, suitable for the production of all types of sausage, does not exist. Casing selection is an important step for production of sausages with pre-defined characteristics. Basic casing characteristics include: mechanical strength, permeability to water and gases, adhesion and elasticity, as well as chemical inertness, impermeability to fat, uniform diameter, resistance to temperature variations, etc. However, the most important casing characteristics, which affect not only the final shape and weight of sausage, parallel to the physical integrity which is necessary to maintain all the technological steps in the production of the final product certainly are mechanical strength and permeability to water and gases[1,2]. Mechanical casing properties are important both for consumers (because they make the difference between edible and non-edible casing), and producers (the casing strength and elasticity have great importance for the process of filling)[3]. The degree of casing permeability, as a barrier between sausages and external environment, depends on the level of exchange of substances from the filling with the environment, and therefore desired processes that occur during production, during which are formed specific structural, compositional and sensory characteristics typical for product. The degree of casing permeability to water, gas and light affects a series of processes such as: loss of water, compositional changes, hydrolysis of fat, pH, a_w, cleavage of fresh sausages, fat oxidation and sensory characteristics. Mechanical properties of casing, such as tension strength, elasticity, temperature resistance, transparency and gloss are responsible for the structural integrity, size, shape, volumetric changes, texture and appearance of the finished product[1].

Casing role is especially important in production of raw fermented sausages. In raw fermented sausages, casing permeability and ability to adjust to changes in sausage volume, which occur during production, play a crucial role in maturation and directly affect the quality of the final product. The final product is a result of interactions between casing and filling during the manufacturing process. Sausages are dried until reaching necessary amount of moisture (a_w value). The acid components of the smoke and, in particular, lactic acid producing bacteria reduce the casing permeability. If casing cannot adjust to changes in sausage volume, it can lead to structural defects of product[1].

2. Fermented sausage casings

For fermented sausages, natural or artificial casings can be used, and they need to be firm, elastic and retractable (following the contraction of stuffing during drying), permeable to smoke, water vapor and gases. For casings used for production of fermented sausages, it is extremely important that they adhere well to stuffing, and not just after stuffing but also during the drying period, when stuffing volume decreases[1,4].

2.1. Natural fermented sausage casing

Natural casings are strong enough to handle pressure during charging, permeable to water vapor, gases and smoke, elastic, firmly adhere against sausage stuffing and can be bound or clipped at the end of sausage[4]. This type of casing is mostly used in production of traditional fermented sausages (Sremska sausage, Slavonski kulen, Banijska sausage etc.), and rarely in industrial production, because of the uneven casing diameter[5,6,7]. In natural casing production process, one or more of the intestinal layers are removed, depending on what type of casing needs to be produced. Removing layers increases permeability and flexibility, but at the same time decreases mechanical resistance of casings[4]. Processing of intestine for casing production should begin as soon as possible after slaughter, preferably while the tissue is still warm and in order to avoid bacterial spoilage, which occurs very quickly, and for easier removal of mesentery and fat. The submucosal membrane that remains after processing is mainly comprised of connective tissue, and is strong, elastic and edible. Small intestines of sheep, goats and pigs are commonly used as small-diameter casing. This type of casing consists only of submucosa, which is why it is considered edible and is mainly consumed with sausage. During processing of bovine and equine small intestine, the muscular layer is usually not removed, in contrast to sheep and pig small intestine, so these casings, even if considered edible, are not consumed, because they are too hard and difficult to chew[4]. In the large intestine, submucosa and muscle layers are firmly linked, so usually this type of casing consists of both layers. This affects casing permeability and mechanical

resistance[4]. Other parts of animal digestive tracts which can be used as natural casings, are processed differently, and have stronger and thicker walls at the end of treatment, wherefore they are considered inedible and need to be removed by peeling from the finished product before consumption[4]. Production processes are completed by measuring, washing with salt water, drying and dry salting at the end, and storage. Natural casings are not frozen, because in this way, they lose their elasticity and firmness[4]. Storage time depends on storage temperature. Dried salted casing in closed containers, whereby they are protected from the influence of light which can cause rancidity of fats, can be stored at 6-8°C over 6 months to 3 years. The storage period is shortened with increasing storage temperature. At temperatures up to + 15°C, casing can be stored up to three months. The storage period can be affected by any residual intestinal fat, which, besides slowing the drying process, oxidizes and shortens the shelf life[1,4]. Natural casings are usually available dried and salted. Before stuffing, salt must be rinsed off with cold water. Dry-salted casings then need to soak in water for several hours (3-5 hours in warm water, or overnight in cold water). Immersion in water not only removes residual salt, but makes the connective tissue collagen fibers become more elastic. The addition of organic salts, especially lactic acid (2%), also contributes to this effect. Elasticity is an important characteristic of intestinal casings which is expressed during sausage drying, when the intestinal casing follows the volume of sausage, which gradually decreases. During smoking and drying, natural casings become more rigid and their permeability reduces. A second storage method for natural casings is in saturated saline solution. These casing are ready to use after only a couple of minutes to an hour of soaking, and thorough rinsing. If natural casings are stored in this way, they must be refrigerated. Use of natural casings can be a risk for human health because of different biological hazards (prions, *Salmonella* spp., *Clostridium* spp.)[8,9].

2.2. Artificial fermented sausage casing

Artificial casings were created at the beginning of the twentieth century, when in some countries, requirements of the meat industries, which were rapidly developing, overcame supplies of natural casings. Following development of stuffing machines, artificial casings were adapted to requirements of these systems, primarily in terms of uniformity. Artificial casings have an advantage from the hygienic point of view, because microbiological contamination is negligible, storage at low temperatures unnecessary, and there is no problem with product spoilage during storage and transport. Today, artificial sausage casings are a better choice for production of large diameter sausages, while they are equivalent to natural casings in production of small diameter sausages[1,4,10]. According to structure and composition, artificial casings are divided in two groups: natural material artificial casing and synthetic material artificial casings. In first group are plant origin cellulose material casings and collagen casings (animal origin). Synthetic casings are made of polymer (plastic) material, they are impermeable to gases and water vapor and cannot be used in sausages that need to pass through a drying phase, maturation or fermentation, such as dried sausage[1,4]. Artificial wrappers that satisfy the requirements of fermented sausage production are fibrous and collagen wrappers.

Cellulose is of plant origin, obtained from wood or cotton. Due to its high mechanical resistance and ability to adjust to changes in sausage volume, it is suitable for production of sausage casing (expands when soaked in water, and during drying, on the surface of sausages there is no formation of wrinkles). In addition, it has some more very important properties such as gases, smoke and water vapor permeability. Of the various types of casing based on cellulose, for the fermented sausage production, fibrous casings are the most suitable[1,4]. Fibrous casings are cellulose casings strengthened with strong cellulose fibers. This type of casing needs to soak in warm water for at least 30 minutes before use. Because these casings are sufficiently resistant, they can be used for large diameter sausages, and can be smoked. During stuffing and smoking, casings often break, but with these types of casings, breakage is extremely rare. Although the use of fiber casings means the shiny surface of sausage is not formed, the casing itself can be high-quality printed to give an attractive appearance. Usage of this casing is particularly significant in sausage production where mechanical strength and uniformity of diameter are especially important because of cutting and packaging.

Collagen is of animal origin and it is derived from connective tissue. Collagen casing is permeable to smoke and water vapor. Larger diameter sausages must have thicker casings, in contrast to smaller diameter sausage casings

that can be thinner, gentler, more easy to chew and edible. Collagen casings are a viable alternative to sheep, goat and pig casings. Collagen casings of 32 mm and more usually are not consumed as part of the sausage and should be removed before consumption. This casing type can be used for most types of raw sausages. The advantage of collagen casings is their uniform diameter and strength, and that they can be used without soaking in water[1,4].

3. Conclusions

Artificial casings have an advantage from the hygienic point of view, because microbiological contamination is negligible, storage at low temperatures unnecessary, there is no problem with product spoilage during storage and transport. Also uniformity of artificial sausage casings is very important in industrial production of fermented sausages. Artificial sausage casings are a better choice for production of large diameter sausages, while they are equivalent to natural casings, for production of small diameter sausages.

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